Sonographic Diagnosis of Nontraumatic Musculotendinous Rupture of Hamstring

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With the recent advances in equipment and software, ultrasonography (US) has been widely used in the diagnosis of muscle injury. We report a case of hamstring muscle tear initially diagnosed by US and subsequently confirmed by magnetic resonance imaging (MRI). The patient received conservative treatment and rehabilitation, after which the symptoms gradually subsided. US was used as the initial tool to identify the muscle injury and to assess the severity of the tear, as this technique has been proved to be equal in sensitivity to MRI by previous researchers. We conclude that US is a reliable and cost-effective tool in the detection of muscle injuries.

KEY WORDS — magnetic resonance imaging, sports, tear, ultrasound

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Introduction

Complex injury of the hamstring is common in athletes [1–4]. This injury may vary from a simple strain to complete rupture. It is sometimes difficult to assess the severity of an injury based on clinical examination. However, the management of muscle injury is highly dependent on the severity of the injury. In a simple strain, recovery usually occurs within 1–2 weeks, while a partial tear requires 4–6 weeks of inactivity to guarantee complete healing [5]. Surgical repair is required for a complete rupture [6,7].

Magnetic resonance imaging (MRI) is a reliable tool in the assessment of muscle and tendon injuries [8–11]. However, it is not practical as a first imaging tool in musculotendinous injuries, because it is expensive and is not always available. In comparison, ultrasonography (US) is accessible as a first imaging tool in the assessment of musculotendinous injuries [12]. In this report, we present the US diagnosis of a semitendinosus muscle rupture in an athlete who was successfully treated using rehabilitation programs. We also discuss the advantages and disadvantages of US as an imaging tool in the assessment of musculotendinous injuries.

Case Report

A 21-year-old man presented to our rehabilitation clinic complaining of right posterior thigh pain.

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He was a baseball outfielder. In early August 2006, he experienced a sudden onset of posterior thigh pain while jogging during regular training. Mild swelling over the right posterior thigh was noted without ecchymosis or lumps. The initial impression was that of muscle strain. His symptoms gradually subsided following conservative treatment, i.e. analgesics, ice packing, and rest. Unfortunately, another injury occurred 2 weeks later. He experienced sudden excruciating pain in the right posterior thigh while over-striding to shift his body weight leftward to catch a ball. The injury prohibited him from competitive activities.

Physical examination revealed swelling and tenderness at his right thigh. One palpable lump was noted at the posteromedial aspect of the thigh. No bruising or ecchymosis was observed. The muscle strength of the right knee flexor was only slightly decreased. However, severe pain could be induced with semi-squatting. Hamstring muscle rupture was suspected. US (12 MHz; Xario, Toshiba, Japan) of his right thigh demonstrated disruption of muscle fibers at the musculotendinous junction of the semitendinosus muscle (Fig. 1). With a diagnosis of semitendinosus muscle rupture, MRI of the right thigh was carried out and revealed interstitial hyperintensity mixed with focal hypointensity, and a feathery distribution of edema at the distal semitendinosus muscle on T2-weighted images. The muscle was discontinuous with a tapering end at its musculotendinous junction and focal retraction of muscle fibers, leading to a focal hyperintense gap (Fig. 2). Muscle strain and a partial tear at the musculotendinous junction of the distal semitendinosus were diagnosed.

He was advised to stop all sporting activities and received physical therapy. After a month of rehabilitation, his symptoms subsided and he returned to training camp.

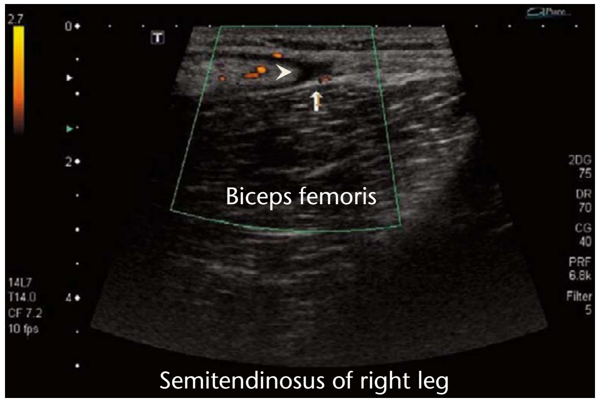

Fig. 1. *Longitudinal ultrasonography scanning of semitendinosus muscle demonstrates focal disruption of muscle fiber (arrow), and round end of the muscle indicating muscle rupture with retraction (arrowhead). The surrounding hypervascularity implied an inflammatory process.*

Discussion

This work shows that US is particularly useful in detecting musculotendinous tears of the hamstring muscle. In the study of 81 football players with muscle injuries of the lower limbs by Megliola et al [13], MRI and US showed complete concordance in 71 patients (site, type and extent of injury). When MRI was taken as the golden standard, US had a sensitivity of 87.65% in identifying muscle injuries. In the study by Connell et al [14], 60 professional football players with muscle injuries were assessed simultaneously using US and MRI at day 3, 14 and 42 after injury. It was found that MRI and US had equal accuracy in identifying hamstring injuries at the time of initial evaluation. In addition, both MRI and US reliably detected the size of the injury and predicted the time it would take for the athletes to return to full competition. However, Koulouris and Connell [12,15] reported that MRI was more reliable than US for documenting avulsion injury, which often occurs in the proximal part of the hamstring muscle. The diagnostic challenge in muscle injuries is compounded by the depth of the injury. In injuries of the proximal hamstring muscle, the overlying gluteal muscles may absorb most of the ultrasound and make the diagnosis difficult. MRI has been shown to be superior to US in deep-seated muscle injuries [6].

US should and can be performed in muscle injuries at an early stage. Bleeding frequently occurs in muscle injuries, and blood often tracks along

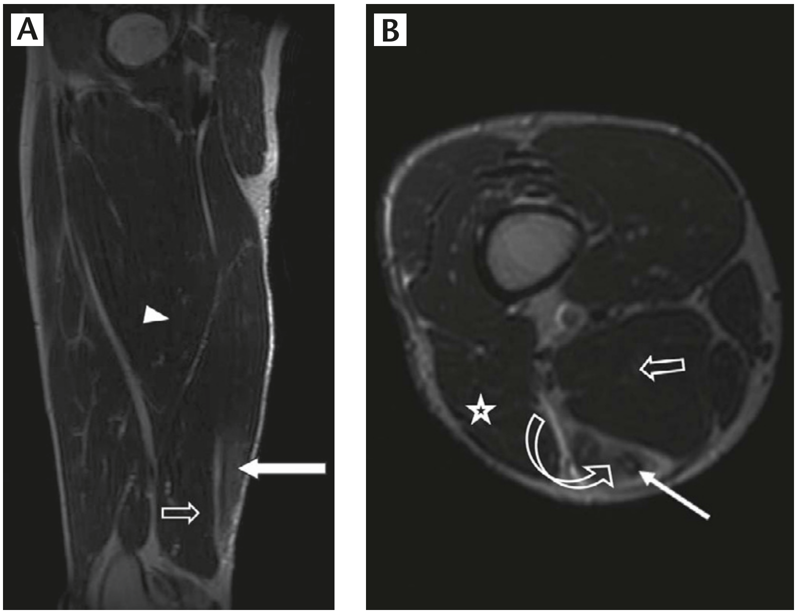

Fig. 2. *(A) Sagittal T2-weighted magnetic resonance imaging (MRI) (fast spin echo; repetition time, 4,700 milliseconds; echo time, 92 milliseconds) demonstrates high signal intensity with abruptly tapered musculotendinous junction at the distal semitendinosus muscle (arrow). The arrowhead indicates the adductor magnus muscle, and the open arrow indicates the semimembranosus muscle. (B) Axial T2-weighted MRI (fast spin echo; repetition time, 3,067 milliseconds; echo time, 88 milliseconds) demonstrates high signal intensity in the region of the musculotendinous junction of the semitendinosus muscle, indicating a muscle tear and edema (curved arrow). The focal high signal intensity at the central area of low signal intensity tendon represents the torn retracted central tendon (arrow). The open arrow indicates the semimembranosus muscle, and the asterisk indicates the long head of biceps femoris.*

muscle bundles and can be found within the subcutaneous fascial boundaries. US is sensitive in the detection of muscle tears in the presence of fluid collections or hematomas, and allows good visualization of the disruption in the distal hamstring. In the study by Peetrons [16], the ideal time to evaluate muscular injury was between 2 and 48 hours after trauma. The hematoma would still be forming in the first 2 hours, and may spread outside the muscle 48 hours after injury.

Besides diagnosing muscle injuries, US plays an important role in the management of these injuries. A persistent intramuscular hematoma could impair the healing process, acting as a chemical irritant to the muscle and leading to muscle spasm or reflex inhibition of normal muscle contraction. This would thus cause muscle atrophy and further prolong the time that the athlete is unable to take part in sporting competitions. In this condition, intramuscular hematoma may warrant intervention, particularly in the athletic setting [15]. Although there is no solid evidence of the benefit of intramuscular hematoma aspiration, it is clinically believed that aspiration of a large hematoma is beneficial and hastens recovery [5]. US is the ideal modality in this instance, as it is perfectly placed to dynamically visualize the hematoma while a drainage catheter is temporarily inserted to remove the collection [17].

MRI has been the imaging modality of choice for the evaluation of acute musculotendinous injuries over the past few decades [8–10]. However, the portability and availability of US makes it an attractive modality for the diagnosis of acute muscle injuries. MRI not only allows clinicians to diagnose and assess the severity of an injury but also provides useful clues for the evaluation of prognosis [10,14,18]. Recent advances in equipment have dramatically improved the image quality of US systems. High-frequency (9–13 MHz) linear transducers markedly enhance image spatial resolution. Current technologies allow in-plane resolution of

200–450 μm and a section thickness of 0.5–1.0 mm, which exceeds those obtainable with routine MRI [19]. Additional hardware and software packages allow extended field-of-view reconstructions of areas up to 60 cm long. Real-time US offers the best dynamic study for prompt image-guided procedures such as aspiration of fluid collections. Furthermore, the use of Doppler US allows the depiction of tissue inflammation and vascularity.

In this report, the patient was diagnosed 2 weeks after injury using US. US demonstrated the complete discontinuity of the muscle fibers associated with the hypoechoic hematoma. Power Doppler US revealed increased vascularity surrounding the lesion. Complete muscle rupture was suspected. MRI revealed myofibrillar disruption without retraction of the muscle, and a partial tear was diagnosed. Because the scanning field-of-view with US is more limited, the degree of musculotendinous tear is sometimes difficult to determine. To overcome this problem, we suggest US with the muscle contracted for viewing the gap caused by the musculotendinous tear.

We conclude that in the acute stage of injury, US not only is as sensitive as MRI but also provides a cost-effective, rapid and available imaging modality for the diagnosis of most hamstring injuries. Furthermore, it provides information which can be directly correlated with the patient's symptoms and is a convenient tool for image-guided procedures.

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